

# TECHNICAL SPECIFICATION



**Internet of Things (IoT) – Generic trust anchor application programming interface for industrial IoT devices**

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## CONTENTS

FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	10
2 Normative references .....	10
3 Terms and definitions .....	10
4 Abbreviated terms .....	12
5 Architecture.....	14
5.1 General.....	14
5.2 Relation to ISO/IEC 30141 .....	14
5.3 Intended target environment .....	14
5.4 Functional scope.....	15
5.5 Concepts .....	15
5.5.1 Abstraction .....	15
5.5.2 Object information model.....	20
5.5.3 Identifiers .....	22
5.5.4 Personalities.....	23
5.5.5 Profiles .....	24
5.5.6 Device states.....	25
5.5.7 Access control.....	25
5.5.8 Secure element properties.....	26
5.6 Implementation view .....	28
5.6.1 System design considerations .....	28
5.6.2 Personalities.....	29
5.6.3 Profiles .....	30
5.6.4 Device states.....	32
5.6.5 Access control.....	37
5.6.6 GTA API start-up .....	40
6 API specification.....	41
6.1 Overview .....	41
6.2 Language binding .....	46
6.3 Endianness.....	46
6.4 Exception handling .....	46
6.5 Using GTA API from an application.....	46
6.5.1 Header files.....	46
6.5.2 Call conventions and error handling.....	46
6.6 Types and function documentation.....	47
6.6.1 Basic types.....	47
6.6.2 General management functions .....	50
6.6.3 Process synchronization.....	55
6.6.4 Secure memory management .....	59
6.6.5 Function parameter I/O streams .....	61
6.6.6 Instance management functions .....	65
6.6.7 Context management functions.....	67
6.6.8 Access token functions .....	71
6.6.9 Device state management functions .....	75
6.6.10 Identifier and personality management .....	77

6.6.11	Access policy management functions.....	97
6.6.12	Data protection functions .....	106
6.6.13	Channel protection functions .....	109
6.6.14	Supplementary security functions .....	114
6.6.15	Trusted execution environment.....	115
6.6.16	Secure element provider implementation support.....	115
Annex A (normative) GTA API C header files .....		119
A.1	Dependencies .....	119
A.2	Application interface – gta_api.h .....	119
A.3	Provider interface – gta_apif.h .....	119
A.4	Handles – gta_handle.h .....	119
A.5	Function parameter I/O streams – gta_stream.h.....	120
A.6	Error information – gta_errinfo.h .....	120
A.7	Secure memory management – gta_secmen.h .....	120
A.8	Process synchronization – gta_psync.h.....	120
Annex B (normative) Basic profiles .....		121
B.1	ch.iec.30168.basic.passcode .....	121
B.1.1	Description .....	121
B.1.2	Deployment .....	121
B.1.3	Usage.....	122
B.2	ch.iec.30168.basic.local_data_integrity_only .....	122
B.2.1	Description .....	122
B.2.2	Creation .....	122
B.2.3	Usage.....	123
B.3	ch.iec.30168.basic.local_data_protection.....	124
B.3.1	Description .....	124
B.3.2	Creation .....	124
B.3.3	Usage.....	124
Annex C (informative) Example security scenarios for Industrial IoT .....		126
C.1	Analysis of example security scenarios for IIoT.....	126
C.1.1	General .....	126
C.1.2	Scenarios for application protocols .....	126
C.1.3	Secure device identities.....	131
C.1.4	Supply-chain and trustworthiness/authenticity of device.....	132
C.1.5	Device integrity protection .....	133
C.1.6	Application security .....	134
C.1.7	Feature licensing .....	136
C.1.8	Device and machine management .....	137
C.1.9	Blockchain/distributed ledger technology .....	140
C.1.10	GTA management.....	141
C.2	Security requirements for security scenarios .....	142
C.2.1	General .....	142
C.2.2	General or nonfunctional requirements .....	142
C.2.3	Functional security requirements overview and description.....	143
C.2.4	Security requirements for OPC UA.....	145
C.2.5	Security requirements for PROFINET security extensions.....	145
C.2.6	Security requirements for secure communication .....	146
C.2.7	Security requirements for secure device identities .....	146
C.2.8	Security requirements for trustworthiness/authenticity of device .....	147

C.2.9	Security requirements for device integrity protection.....	147
C.2.10	Security requirements for application security.....	148
C.2.11	Security requirements for feature licensing.....	148
C.2.12	Security requirements for device management.....	149
C.2.13	Security requirements for blockchain/distributed ledger technology.....	149
C.2.14	Security requirements for GTA management.....	150
Annex D (informative)	Security classes and attestation.....	151
D.1	Security classes/levels.....	151
D.2	Offline validation of security level by organizational means (out-of-band).....	152
D.3	Online validation of security level by attestation (in-band).....	152
D.3.1	General.....	152
D.3.2	Attestation of SE or GTA API runtime for a specific device.....	152
D.3.3	Attestation of personalities and their attributes.....	152
D.3.4	Attestation of a transaction.....	153
D.3.5	Detached attestation.....	153
Annex E (informative)	Examples for further illustration of GTA API concepts.....	154
E.1	Pre-initial device state example for TPM.....	154
E.2	Composing systems from subsystems containing SEs.....	155
E.3	Example deployment of SEs in a composite system design.....	156
Annex F (informative)	Implementation guidance.....	160
F.1	Host platform abstraction.....	160
F.2	Buffer management.....	160
F.3	Signalling and semaphores.....	160
F.4	Coding style.....	161
F.5	Secure coding.....	161
Annex G (informative)	Example code.....	162
G.1	General.....	162
G.2	Using GTA API with <code>ch.iec.30168.basic.local_data_protection</code> .....	162
G.3	Using GTA API with <code>ch.iec.30168.basic.local_data_integrity_only</code> .....	165
G.3.1	General.....	165
G.3.2	Protection with data recovery.....	165
G.3.3	Detached protection.....	165
G.4	Protecting a personality with <code>ch.iec.30168.basic.passcode</code> .....	167
G.5	Example for a simple buffer stream.....	170
G.5.1	<code>myio_bufstream.h</code> .....	170
G.5.2	<code>myio_bufstream.c</code> .....	172
G.6	Secure element provider template.....	174
Bibliography	.....	175
Figure 1	GTA API environment.....	15
Figure 2	GTA API modular architecture interfaces.....	16
Figure 3	Crypto technology driven API design.....	18
Figure 4	GTA API security service driven API design.....	19
Figure 5	Multi-application capability.....	19
Figure 6	Secure element abstraction.....	20
Figure 7	Object information model (static view).....	21

Figure 8 – Object information model (runtime view) .....	22
Figure 9 – Value creation chain .....	25
Figure 10 – Device state stack .....	33
Figure 11 – Device state transitions .....	33
Figure 12 – Device state stack (push) .....	34
Figure 13 – Device state stack (pop) .....	34
Figure 14 – Access token .....	37
Figure 15 – Personality derived access token .....	39
Figure 16 – Access policy composition (BNF) .....	40
Figure 17 – GTA API start-up phases .....	41
Figure 18 – Example gta_personality_enumerate() .....	78
Figure 19 – Example access policy handling by SE provider .....	99
Figure 20 – Channel protection functions .....	110
Figure A.1 – Dependency graph for gta_api.h .....	119
Figure C.1 – Device management .....	138
Figure E.1 – Composing systems from subsystems containing SEs .....	155
Figure E.2 – Example: Robot as a composite system .....	156
Figure E.3 – Example: SEs deployed within composite system .....	157
Figure E.4 – Example: Component device states .....	159
Table 1 – Access control .....	26
Table 2 – Mapping between SE properties and protection goals .....	28
Table 3 – Properties of personality creation profiles .....	31
Table 4 – Properties of personality deployment profiles .....	31
Table 5 – Properties of personality enrollment profiles .....	31
Table 6 – Properties of personality usage profiles .....	32
Table 7 – GTA API function groups .....	42
Table 8 – GTA API feature classes .....	43
Table 9 – GTA API functions per feature class .....	43
Table 10 – Basic profiles .....	50
Table 11 – GTA API functions with access control .....	71
Table B.1 – ch.iec.30168.basic.passcode deployment properties .....	121
Table B.2 – ch.iec.30168.basic.passcode usage properties .....	122
Table B.3 – ch.iec.30168.basic.local_data_integrity_only creation properties .....	123
Table B.4 – ch.iec.30168.basic.local_data_integrity_only usage properties .....	123
Table B.5 – ch.iec.30168.basic.local_data_protection creation properties .....	124
Table B.6 – ch.iec.30168.basic.local_data_protection usage properties .....	125
Table C.1 – Scenarios for OPC UA client and server .....	127
Table C.2 – Security classes for the PROFINET protocol .....	130
Table C.3 – Scenarios for PROFINET security .....	130
Table C.4 – Scenarios for secure communication protocols .....	131
Table C.5 – Scenarios for secure identities .....	132
Table C.6 – Scenarios for device trustworthiness .....	133

Table C.7 – Scenarios for system integrity protection.....	134
Table C.8 – Scenarios for know-how protection .....	135
Table C.9 – Scenarios for feature licensing.....	137
Table C.10 – Scenarios for device management .....	139
Table C.11 – Scenarios for blockchain/distributed ledger technology (DLT) .....	141
Table C.12 – Scenarios for GTA management .....	142
Table C.13 – General or nonfunctional requirements .....	142
Table C.14 – GTA-API functional security requirements.....	143
Table C.15 – Security requirements for OPC UA.....	145
Table C.16 – Security requirements for PROFINET security extensions.....	146
Table C.17 – Security requirements for secure communication .....	146
Table C.18 – Security requirements for secure device identities .....	147
Table C.19 – Security requirements for trustworthiness/authenticity of device.....	147
Table C.20 – Security requirements for device integrity protection .....	148
Table C.21 – Security requirements for application security .....	148
Table C.22 – Security requirements for feature licensing .....	149
Table C.23 – Security requirements for device management.....	149
Table C.24 – Security requirements for blockchain/distributed ledger technology.....	150
Table C.25 – Security requirements for GTA management.....	150
Table D.1 – Example security levels .....	151

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# INTERNET OF THINGS (IoT) – GENERIC TRUST ANCHOR APPLICATION PROGRAMMING INTERFACE FOR INDUSTRIAL IoT DEVICES

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ISO/IEC TS 30168 has been prepared by subcommittee 41: Internet of Things and Digital Twin, of IEC technical committee JTC 1: Information technology. It is a Technical Specification.

This document contains attached files in the form of GTA API C header files and a secure element provider template that are cited in Annex A and Clause G.6. These files are intended to be used as a complement and do not form an integral part of the publication.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
JTC1-SC41/388/DTS	JTC1-SC41/413/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

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## INTRODUCTION

Industrial Internet of Things (IIoT) devices face increasing security requirements. This insight is especially important as more and more devices become connected directly or indirectly to the Internet. It is essential that IIoT devices are prepared to perform secure communications for service interaction, monitoring, and control.

However, security is often still observed as rather complex by implementers and integrators. This perception often results in realization obstacles when the integration and use of security mechanisms and secure elements (SE) is wanted.

This document provides a versatile application programming interface (API) for security to allow a generic integration of SEs into IIoT devices. The API is vendor independent and also independent regarding the SE technology being deployed. This approach simplifies redesign for different SEs and supports software-hardware co-design for security. SEs offering different security properties facilitate the selection of an SE according to the intended use, protection goals, and other boundary conditions. The API aims at achieving high-level abstraction profiles for security services and mechanisms to avoid typical low-level interoperability complexity and implementation failures. Requirements and architectural constraints from IIoT applications shape the final design of the API and its usability.

The resulting API facilitates the security-by-design defined integration of security components within IIoT components on a large scale. The time-to-market for secured devices is accelerated. Stakeholders will benefit from higher security levels being available for lower prices. Application of updates and continuous improvements of security along the lifecycle of products and systems are facilitated.

The following stakeholders and their corresponding interests play a role for the generic trust anchor application programming interface (GTA API) definition:

- Manufacturers and users of industrial equipment
  - Scalable use of adequate (hardware-based) security technologies depending on required security, multivendor support, migration strategy, or long-term suitability.
- Software developers
  - Increased robustness due to use of a unified API.
  - Ease of use for developers without dedicated security expertise.
- Manufacturers of security ICs or ICs offering security functions
  - Promote use of hardware-based trust anchor technologies for IIoT devices.
- Conformity Assessment Bodies

# INTERNET OF THINGS (IoT) – GENERIC TRUST ANCHOR APPLICATION PROGRAMMING INTERFACE FOR INDUSTRIAL IoT DEVICES

## 1 Scope

This document specifies a generic application programming interface (API) for the integration of SEs within Industrial Internet of Things (IIoT) devices. It considers needs from industrial usage scenarios and applications. This document also provides guidance for implementation, testing, and conformity validation.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEEE Std 802-2014, *IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture*

IETF RFC 1035, P. Mockapetris, "Domain names – implementation and specification", November 1987, available at <https://www.rfc-editor.org/info/rfc1035> [viewed 2023-08-29]

IETF RFC 1779, S. Kille, "A String Representation of Distinguished Names", March 1995, available at <https://www.rfc-editor.org/info/rfc1779> [viewed 2023-08-29]

IETF RFC 4122, P. Leach, M. Mealling, and R. Salz, "A Universally Unique Identifier (UUID) URN Namespace", July 2005, available at <https://www.rfc-editor.org/info/rfc4122> [viewed 2023-08-29]

IETF RFC 8446, E. Rescorla, "The Transport Layer Security (TLS) Protocol Version 1.3", August 2018, available at <https://www.rfc-editor.org/info/rfc8446> [viewed 2023-08-29]

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

### 3.1 attack

attempt to gain access to an information processing system in order to produce damage

Note 1 to entry: The damage can be, for example, destruction, disclosure, alteration, unauthorized use.

[SOURCE: IEC 60050-171:2019, 171-08-12]

### 3.2

#### **generic trust anchor application programming interface**

##### **GTA API**

set of well-defined methods, functions, routines, or commands for application software to facilitate the programming languages use of cryptographic or protected resources from an SE that is used as trust anchor

### 3.3

#### **IoT device**

entity of an IoT system that interacts and communicates with the physical world through sensing or actuating

Note 1 to entry: Industrial IoT device is an IoT device which is intended for use by qualified and experience personnel in a controlled manufacturing or processing environment.

Note 2 to entry: For example, industrial uses are smart manufacturing, robot, energy, automobile, transportation, building, and so on. Such an entity can interact with digital twins or asset administration shells of other entities.

Note 3 to entry: An entity can be the combination of the device and a simple sensor. The device comes with a GTA API instance. The sensor does not have an intelligent control unit and does not come with its own GTA API instance.

Note 4 to entry: Industrial IoT devices are not limited to sensor or actuator. Industrial IoT devices include embedded devices such as smart sensor/actuator, programmable logic controller (PLC), edge device (for example, Industrial PC) but not limited to sensor and actuator.

[SOURCE: IEC 60050-741:2020, 741-02-04, modified – The original Note to entry has been replaced with Notes explaining the use of the term in an industrial context.]

### 3.4

#### **know-how protection**

measures supporting the protection against extraction of knowledge or expertise represented by software or other intellectual property from a device

### 3.5

#### **personality**

set of trusted information and cryptographic key material that is used by an application in a specific security context

Note 1 to entry: A personality typically includes the device's own cryptographic material like private keys, secret keys, own public key certificates. A personality can also include information required to establish trust towards partners.

Note 2 to entry: A personality is used within the scope of a specific application. A device can use different personalities in different application contexts.

### 3.6

#### **public key certificate**

set of data that uniquely identifies an entity, contains the public key of the entity, and is digitally signed by a trusted party to bind the public key to the entity

### 3.7

#### **secure element**

##### **SE**

component capable of securely hosting functionalities or confidential and cryptographic data or both in accordance with well-defined rules and security requirements

Note 1 to entry: A typical solution for an SE is a one chip microcontroller.

Note 2 to entry: Cryptographic keys are an example of confidential and cryptographic data.

Note 3 to entry: An SE can be realized as pure software component to support future migration to a hardware SE.

Note 4 to entry: An SE can provide special physical protection features such as tamper protection.

### 3.8

#### **side-channel analysis**

exploitation of the fact that the instantaneous side-channels emitted by a cryptographic device depends on the data it processes and on the operation it performs to retrieve secret parameters

[SOURCE: ISO/IEC 17825:2024, 3.9]

### 3.9

#### **trust anchor**

essential security capability that, by definition, must be trusted

Note 1 to entry: A trust anchor can provide provisions to protect the integrity and confidentiality of functions and related information that are required by an application.

Note 2 to entry: The security capability to achieve protection can be provided with an SE. The SE can provide functionality for, for example, secure generation and use of cryptographic key material, and tamper-protected storage of public key certificates.

Note 3 to entry: Data sets, for example, public key certificates starting a certification path, require additional protection against manipulation to be considered as trust anchor. This additional protection can be achieved by, for example, storage in a shielded location.

## 4 Abbreviated terms

AES	Advanced Encryption Standard
ASN.1	Abstract Syntax Notation One
CA	Certification Authority
CERT	Computer Emergency Response Team
CHAP	Challenge handshake authentication protocol
CO	Component
DCP	Discovery and basic Configuration Protocol
DER	Distinguished Encoding Rules
DH	Diffie-Hellman
DNS	Domain Name System
DSS	Digital Signature Scheme
DTLS	Datagram Transport Layer Security
EC	Elliptic Curve
EK	Endorsement Key
ECDSA	Elliptic Curve Digital Signature Algorithm
FGPA	Field Programmable Gate Array
GDS	Generic Discovery Service
HSM	Hardware Security Module
IACS	Industrial automation and control system
IANA	Internet Assigned Numbers Authority
IDevID	Initial Device Identifier
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
IPC	Industrial Personal Computer
IPsec	Internet Protocol Security
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6